

TECHNOLOGY DEPT.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLIX
No. 1261

SATURDAY, AUGUST 28, 1943
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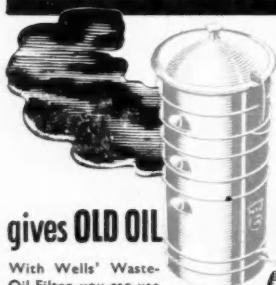
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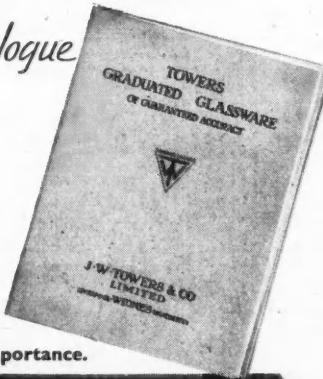
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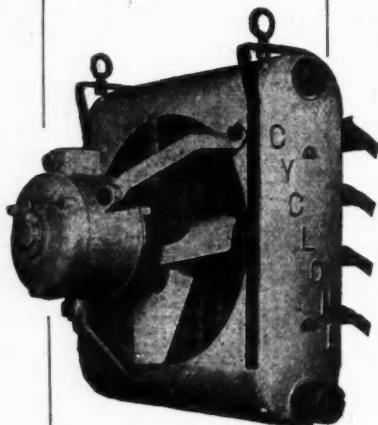
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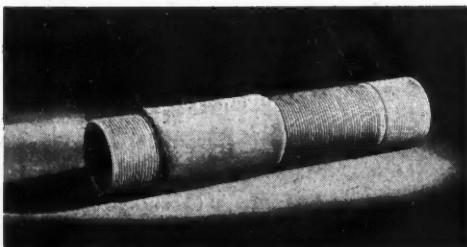
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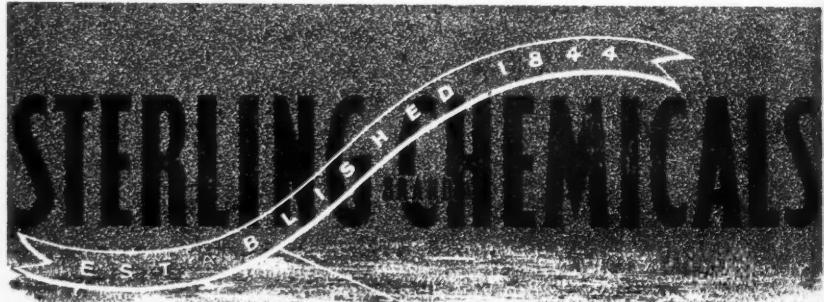
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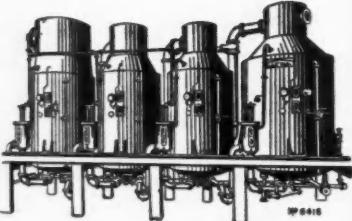
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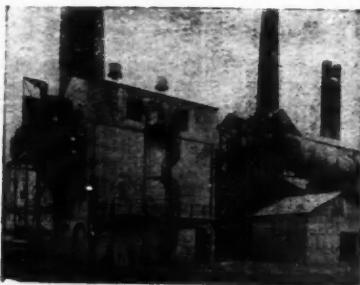
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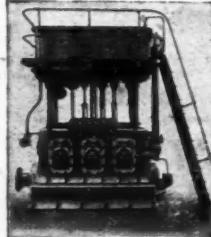
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Cartels

A GOOD deal of adverse comment has been heard in Parliament about the operation of cartels and similar arrangements for the control of trade. Among members of Parliament and among the general public there would appear to be deep distrust of all such arrangements. This distrust is deep-seated and goes back to the days of American Trusts, which were nothing less than an attempt by manufacturers to force the public to pay excessive prices for goods which they not only desired to purchase, but required for the maintenance of a reasonable standard of living. Those were the days when the guiding principle of business was to buy in the cheapest market and sell in the dearest. Anyone who could make 10 per cent. more profit than his neighbours was then considered a smart business man; as no doubt he was, according to the standards ruling. That these standards no longer rule the commercial world, that they have been replaced by the principle of a fair return for the labour and capital employed, is evidence of how far the world has advanced on the social plane in the past fifty years.

It is more than that. It is also one of the major answers to those who question

the desirability of cartels, or trade associations, or any other item of the modern machinery for the control of industry and commerce. So long as business men sought to obtain inflated profits, the world was justified in looking askance at anything that appeared to partake of the nature of a "Trust." With the changed spirit pervading industry, that suspicion is no longer justified. It is well that this fact should be made clear, because the suspicions that are still voiced are contributing in no small measure to delaying our post-war trading plans. It is obvious that trade after the war will be divided into three periods. First, there will be the period of reconstruction in which every war factory will be turned over to produce whatever goods are necessary for the rehabilitation of the stricken countries and for the replacement of the worn-out plant and machinery of the Allied nations. How long this period will last it is impossible to forecast, but it may well be three years or more. During this time the Government will probably find it necessary to continue some form of priority in order that the most essential things in each industry shall be done first. It is next to impossible to arrange for suitable control without the colla-

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boration of the industries concerned. The problem goes even a little deeper than that, for we shall be helping our future foreign competitors to reconstruct their works, and it would only be natural that in doing so we should have some arrangement with them to ensure that such markets as may be found to exist after this period shall be fairly shared in accordance with the rule that the consumer shall be charged a fair price without cut-throat competition. Home trade associations and international cartels are essential if this arrangement is to work.

The second period will be one of diminishing demand, and may well require that certain factories erected for war purposes shall be closed and that orders accumulated by these factories shall be distributed among existing firms. Again, the cartel and the trade association will be essential as an instrument for bringing the desired arrangements about and putting them into effect. The third period will be one of stabilisation, in which the reconstruction will have been completed and trade will shrink to its normal peace-time dimensions. It is hoped that these "normal" requirements will be very greatly expanded by an increased standard of living both at home and abroad, but we cannot be sure of that. For this period the demand has been made by Labour and by the Government that industry must plan for full employment. How this is to be done if industry may not organise itself as it deems best for the purpose is not at all clear. There can be no doubt that this continual suspicion of cartels is delaying the necessary arrangements. Business men are saying frankly that they cannot do such and such things until they know "in what direction the political cat will jump." This Government may be a reasonably good compromise for carrying on a war, but it has not shown as yet any aptitude for working out a peace. A mixture of the various parties, each dependent on the back-benchers of its party, seems to be incapable of making up its collective mind on what "set-up" of industry should be encouraged after the war. The fear that a Government, actuated by false socialist sentiment, may, in its haste, nullify the good that could be done is preventing much post-war planning for the better control of trade. This is plain speaking, but the

sooner the politicians realise that industry is not trying to gain its selfish ends, but only to secure a stable basis for its operations, the better it will be for everyone concerned.

Governments are quite within their rights in asking to see and to improve international and even domestic arrangements that may be made by their subjects. They are right to make sure that amid the vast mass of industrialists none who is prepared in even a small degree to exploit the public gains a position of control. But having taken these steps in an open and legal way, let the politicians turn to their politics and leave industry to manage its own house. The basic fact that both politicians and many of those who elect them often forget is that unless industry is prosperous they will be poor. "No nation," said Benjamin Franklin, "was ever ruined by business." "Business" is to-day highly complex and requires expert management; and although there are many industrialists in Parliament, it is still true that the real politician is seldom a business man. We have seen in the past how nations have competed with one another for foreign markets, the result being cut prices and ultimately subsidies (which must be paid for out of taxation). This sort of competition leads to bad blood, and ultimately to war. The international cartel is a means of arranging that the available markets shall be in some way distributed among the manufacturing countries concerned. Prices are naturally arranged, but competition with alternative goods, and the possibility that consumer nations may start their own manufactures, must always induce the cartel to take a very reasonable view of prices.

Regulation is not of itself a final step; it is in some measure a confession of failure, for there is no need to regulate a trade which is working to capacity, except to ensure that more works are not erected than are sufficient to cope with the amount of trade available. Beyond all the trade associations and cartels is the need for stimulating demand. The insistence that industry must plan for full employment is meaningless unless the politicians can devise means for enabling everyone to purchase more and for permitting the standard of living in the backward countries to be raised.

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NOTES AND COMMENTS

Dielectric Heating

ELSEWHERE in this issue we give an account of the application of radio-frequency electrical energy to the heating of insulating materials through dielectric loss, a process sometimes referred to as "radio-frequency heating" or even "radio-thermics." Neglected for years, probably because it was first applied to agricultural products, it has been brought into prominence again, since it has found engineering applications in meeting the demands of war. In U.S.A., the Society of Plastics Engineers has held a symposium on the subject, and radio valve manufacturers are featuring it in their advertisements. It may come into general use in this country, if either the embryonic plastics industry makes a strong demand for it or the radio engineering firms try to develop this new market on the same scale as the American radio valve and component manufacturers.

"Heavy Water" Bombs?

THE R.A.F. raid on the Luftwaffe's research headquarters at Peenemuende, near Stettin, released a flood of speculation as to what "secret weapons" the Nazi scientists might be cooking up there. In technical circles perhaps the most interesting suggestion was that General von Chamier-Gliszenski, the station's director (who is reputed to have been assassinated during the air raid) was in charge of experiments with bombs of which "heavy water" was a constituent. While we give little credence to the report, probably to be rejected as sheer rumour, that one of these bombs weighing only one pound would have the same explosive force as a normal two-ton bomb, we cannot avoid the thought that there may be a grain of truth behind all this speculation. For it is not impossible that the Nazis are going all out in an attempt to create a new weapon that would depend, for its destructive power, upon the energy released in atomic disintegration. It is known for instance that "heavy water" does react with at least one of the unstable elements of the uranium group, releasing swift moving particles capable of causing further atomic disintegration. Before the war started it was known that laboratories in America, Britain, Germany, and

France were investigating the prospects of utilising such atomic energy with the ultimate object of producing a new and more violent explosive. Uranium 235 was frequently quoted as being the particular substance around which this work centred. The theory of the suggested atomic explosive was simple; initial bombardment of the uranium nucleus with slow neutrons would lead to the smashing of that nucleus into two approximately equal pieces, with the discharge of two or more faster neutrons, capable of promoting a further self-accelerating disintegration of the uranium. Whether any progress has been made in this direction only a handful of scientists would know. The rest of us may derive a measure of comfort from the knowledge that in matters concerning atomic physics Britain and America lead the world.

Coal Research Club

THE Coal Research Club has now held its hundredth meeting, and it is very nearly true to say that its members have discussed, since the first meeting on February 11, 1921, a hundred and one different aspects of coal research problems. Its formation was the upshot of an after-dinner conversation between the late R. V. Wheeler and Dr. R. Lessing. It has held meetings regularly ever since, and at these affairs many leading international authorities on coal have presented papers which have been discussed freely and profitably. Membership is restricted to those who have done and are actively engaged in true research into the constitution or utilisation of coal, and one of the rules—indeed the *raison d'être* of the organisation—is that members undertake to render mutual assistance to the best of their ability by information, criticism, and suggestion, and to submit to the club the results of their work in advance of publication. The soundness of these original and unorthodox aims has been abundantly confirmed by the club's own experiences and also by the way practitioners in other branches of science have adopted them, the Americans going so far as to set up a branch of the club in their country. As Dr. Lessing writes in the latest number of the club's journal, "It may be claimed with justifi-

able pride that many of the club's discussions had a decisive influence on the development of coal research during the last twenty years not only in this country, but also abroad."

Quinine and its Substitutes

IT is 46 years this week since it was conclusively proved that the mosquito was responsible for the spread of malaria. This disease, however, still remains a most serious drain on the energies of those who live in the Tropics; its incidence may have fallen, but it still presents a major medical problem, which, to-day, is having to be met by the health services of the Allied armies. Quinine remains, to use the words of the medical experts of the British Army, "the sheet anchor" in the treatment of malaria. The critical shortage of quinine which arose through the loss by the Allies of territory in the Far East was eased to a considerable extent by the existence of substitute chemotherapeutics — the synthetic malarials Plasmoquine (Pamaquin) and Atebrin (Mepacrine). The standard army treatment of malaria, designed to cover a period of a fortnight, relies on the use of quinine during only two days, Mepacrine and Pamaquin being administered separately for five days each. Incidentally, we see from a recent War Office leaflet that quinine is suggested as an alternative for Mepacrine, owing presumably to a shortage of that synthetic drug! One point which worries us is whether all the quinine which, since the Japanese captured our sources of supply, should have been devoted exclusively to the treatment of malaria has been so used. We should like to receive an official assurance that not a grain of this very valuable natural anti-malarial has been wasted—that none of it is being diverted to contraceptives manufacture, for instance, a rumour that is still so persistent in chemical circles that the authorities cannot have failed to hear it.

Frustration of Science

THE Indian scene, whether regarded from the point of view of the politician, the industrialist, or the scientist, presents no happy picture. We have just been reading the presidential address of Sir M. Visvesvaraya on the occasion of the sixth annual meeting

of the Indian Institute of Science of Bangalore. Unlike the too familiar presidential address, stuffed with pleasant platitudes and verbal back-scratching, this speech has an air of reality. It is in fact a straw in the wind, an indication of what Indian scientists as a whole are thinking; as such it cannot be lightly dismissed. In it the restrictions and limitations to which Indian heavy industries have been subjected are contrasted with the phenomenal developments in countries like Australia during the war. The president notes, too, that until recently research has been treated in the same restrictive spirit; important recommendations of such bodies as the Council of Scientific and Industrial Research in favour of heavy industries, like the internal combustion engine, have not been accepted, nor even noticed, by the Government. With not unjustifiable bitterness he adds, "It cannot be said that an industry to manufacture internal combustion engines is not a vital necessity in any country, or that it is not needed in India. I understand, however, that private establishments are attempting its manufacture with some success."

Official Inaction

FURTHERMORE, the president asserts, "There is too much secrecy; no intelligent exposition of policies is available, particularly in regard to industries. No official in high position ever gives a comprehensive interpretation of the views of Government, what they propose to do and why their policies and procedure are so different from those followed in any progressive country or even in the self-governing dominions of the British Commonwealth. There is no directory for war work or for civilian industries. Whatever attempts are made are fragmentary. No stock-taking is done here, no review is attempted, of the industrial and economic affairs of the 390 millions of the population of India. At the present time the Government has taken control of almost every activity in the country and they owe a duty to the public to explain their policies and justify their inaction in respect of the three developments—industries, industrial research for peace-time needs, and post-war reconstruction."

Recent Developments in Analytical Chemistry—VII

(From Our Analytical Correspondent)

Zinc

A VERY full survey has been made of the qualitative reactions which have been recommended at various times for the detection of zinc.¹ In all, 54 reagents have been tabulated together with their advantages and disadvantages. From all these, nine reactions have been picked out as being satisfactory, and these are divided into classes according as they are most useful for: (1) the methods of chemical microscopy—the reagents suggested are pyridine + potassium bromide in neutral solution, potassium ferrocyanide in weak acid solution, or ammonium mercuric thiocyanate + cobalt chloride; (2) spot plate technique, for which the following should be used—ammonium mercuric thiocyanate + copper sulphate in neutral solution, ammonium mercuric thiocyanate + cobalt chloride in neutral solution, *p*-dimethylaminostyryl- β -naphthothiazole in weak acid solution, diphenyl thiocarbazone (dithizone) in neutral solution, or metanil yellow + potassium ferricyanide in acid solution; (3) spot paper tests, where *p*-nitrobenzene-azoresorcinol is the recommended reagent; and (4) the ordinary classical test-tube method, where modifications of one or other of the above reactions are satisfactory.

A wide variety of techniques has been proposed recently for the estimation of zinc quantitatively. Where the metal is to be estimated either in tin base alloys or in such alloys as gun-metal or phosphor bronze, the alloy is brought into solution, and precipitation carried by 8-hydroxyquinoline in the presence of alkaline sodium potassium tartrate solution.² The precipitated complex is then redissolved, and the zinc estimated by a bromometric titration. Two gravimetric methods have been proposed. The first, which is applicable to the small amounts of the metal likely to occur in milk which has been in contact with metal foils, involves the ashing of the solids from the milk, and subsequent solution in dilute hydrochloric acid.³ This solution has the group II metals precipitated by H₂S, following which it is rendered

ammoniacal, and just brought back to the acid side by citric acid. Under these conditions zinc may be precipitated quantitatively by a second application of H₂S. If the amount of zinc is appreciable, it may be ignited to oxide form and weighed, while for quantities below 2 mgm. it is recommended that it be estimated turbidimetrically, using potassium ferrocyanide. The other gravimetric procedure, which is equally effective for cadmium, depends on precipitation of the metal as anthranilate, using sodium anthranilate as reagent.⁴ The precipitate is then dried at 105° C., and weighed without further treatment, the factor for zinc being 0.1936, while that for cadmium is 0.2922. A warning is added to the effect that alkali and ammonia salts, particularly the acetates, appear to have an inhibiting action on the precipitation, so that the method is to be avoided in their presence.

Finally, a rapid electrolytic method has been worked out for the determination of zinc in aluminium alloys. It is claimed for this method that from the point of view of speed it compares well with normal gravimetric procedures, and is distinctly cheaper and simpler.⁵ By a preliminary treatment with 10 per cent. caustic soda most of the zinc is brought into solution. The portion of the alloy which is not thus dissolved is freed from such metals as copper and manganese by solution in acid and electrolysis at 5 amps. for five minutes. The residual solution is joined to the alkaline zinc-containing solution, and boiled in order to precipitate iron and the small amount of manganese which may still be retained. After filtration, electrolysis at 2 amps. for 20 minutes will deposit the zinc completely on a copper-coated platinum electrode.

Tin

Two interesting methods for estimation of tin have been worked out. In the first, which has been applied to the metal in foodstuffs, an ignition is carried out to destroy the foodstuff.⁶ This is followed by a distillation from a mixture of

hydrobromic and sulphuric acids, at 220° C., under which conditions the tin is completely distillable. After freeing the distillate from bromine, the tin may be estimated colorimetrically, using toluene-3 : 4-dithiol (dithiol) as reagent. The other method is volumetric, and depends on a reaction of stannic tin.⁷ For this reason, the tin is, if necessary, first converted to the stannic form by solution in a mixture of concentrated nitric and sulphuric acids, and evaporation till white fumes have come off. When such a stannic solution is allowed to react with potassium oxalate until a pH of 3.3 is reached, the tin will form a complex, potassium oxalatostannate, $K_2Sn_2(C_2O_4)_2$. When H₂S is now passed through this solution, a further complex, dipotassium dioxalothiometastannate, $K_2SnS(C_2O_4)_2$, is the result. After removal of excess H₂S by passage of CO₂, it is found that the sulphur in this latter complex can be titrated against standard iodine. The best method is to add the iodine solution until there is a slight excess, as shown by a faint yellow colour. The amount of this excess is then determined by means of back titration with standard thiosulphate solution, using starch as indicator.

Sodium

A number of modifications of the usual triple uranyl acetate method for estimating sodium have been published. Manganese uranyl acetate, instead of the more usual zinc uranyl acetate, has been investigated as a means to this end, and it has been found possible, by certain modifications, to obtain concordant results for the estimation of the small quantities of sodium which may be found in soil and soil extracts.⁸ The triple sodium manganese uranyl acetate is first precipitated by an alcoholic solution of the reagent, and, after standing for four hours, is filtered off through a G4 sintered glass filter or a porous porcelain filter. The precipitate is washed thoroughly with an alcoholic solution of zinc uranyl acetate, in a standard manner, in order to remove the last traces of the reagent. This pure precipitate is then dissolved up in dilute sulphuric acid, and after removal of the alcohol by boiling, it is converted to permanganate by means of potassium periodate and phosphoric acid. This can then be

measured colorimetrically, or matched in a tintometer. The method is stated to be applicable to quantities varying from 5 to 500 mgm. of sodium. Yet another colorimetric method depends on the intense yellow colour which is produced when a solution of a uranyl salt is made alkaline with sodium or ammonium carbonate and treated with hydrogen peroxide.⁹ Since this yellow colour (deepening to orange-red in stronger solutions) varies in intensity according to the uranyl content in the region around 5200 A.U., it may therefore be applied indirectly to determine the sodium in a sodium triple uranyl acetate precipitate.

A Useful Precipitant

Copper uranyl acetate has been investigated as a precipitant, and is stated to be better than the more usual double acetates for both qualitative and quantitative work on sodium.¹⁰ For precise work the alcoholic reagent is recommended. It is suggested that this reagent might be found useful for the determination of sodium in the presence of considerable amounts of lithium, since lithium does not precipitate readily; application of a small correction might therefore give a true figure for the sodium content. Finally, very minute quantities of sodium may be estimated polarographically.¹¹ The well-defined wave obtained from sodium zinc uranyl acetate dissolved in dilute hydrochloric acid, and arising from the uranyl ion, is proportional to the sodium content. The determination is carried out in a nitrogen atmosphere, while a small mount of caffeine is added as a maximum suppressor. In this way, from 3 to 20 micrograms of sodium may be determined in one ml. of solution obtained from vital tissues.

An entirely different reagent, used in an unusual fashion, has also been proposed.¹² Potassium pyroantimoniate is frequently used as a sodium reagent, but it has been found that a solution of potassium pyroantimoniate may be titrated, using a pH-meter and a quinhydrone electrode, against dilute hydrochloric acid. If a saturated solution of the potassium salt is added to a sodium-containing solution, some of the pyroantimoniate will be precipitated, and from the titration curve the residue of potassium salt in solution can be determined.

From this result, the sodium content may be calculated.

Molybdenum may be estimated colorimetrically in molybdenum and tungsten ores.¹² First iron and other major constituents are removed, and then a solution of ammonium citrate is added. This has the effect of preventing interference by tungsten. When the resulting solution is treated with ammonium thiocyanate and acetone and reduced by stannous chloride, an amber-coloured solution is formed. If a blank experiment is carried out simultaneously, and titrated against standard molybdenum solution until a similar colour is obtained, the amount of standard solution necessary corresponds to the molybdenum content of the ore. Small amounts of the metal may be detected and determined by precipitation as lead molybdate to separate it from interfering elements.¹³ The precipitate is then dissolved up, and lead removed as sulphate. If the filtrate is then taken to dryness on a hot plate, and heated strongly, the presence of the molybdenum is indicated by a blue colour. This reaction may be used quantitatively for amounts of 10 mgm. or more of molybdenum, but if less is present, the blue molybdenum complex is preferably turned into molybdenum sulphide, for colorimetric determination. This is achieved by solution in dilute ammonia solution, acidification with acetic acid, and treatment with aqueous H₂S.

Indium and Vanadium

Indium may be precipitated quantitatively from a sodium acetate-acetic acid solution by 8-hydroxyquinoline.¹⁴ The precipitate, which dissolves readily in chloroform to give a bright yellow solution, may be used quantitatively (colorimetrically), since it has been found that by controlling the pH within the range 3.2 to 4.5, a number of other ions which normally give complexes with 8-hydroxyquinoline, such as zinc, cadmium and lead, are not extracted. Since, however, iron acts in a fashion similar to indium, the method is not feasible without first removing this element.

Vanadium, together with cerium and manganese, may be estimated because of its behaviour with ozone.¹⁵ If a vanadium (vanadous) solution is treated with ozone, it is oxidised to the vanadyl form in the presence of perchloric acid. The ozone

is easily obtainable from a small ozoniser. In order to determine when all the vanadous salt has been oxidised, it is possible to make use of the analogous reaction with the manganous ion. This latter is oxidised only when all the vanadous salt has been converted. Consequently, as soon as a pink colour appears in a solution which has added to it a trace of manganous salt, the vanadium reaction may be considered to be complete. The pink colour is just removed with azide or nitrite solution, and a titration of the vanadyl salt is carried out against ferrous sulphate solution, using oxidised diphenylamine as indicator. If it is desired to estimate manganese by this method, the resultant permanganate is determined by means of excess ferrous sulphate, followed by back titration with standard permanganate. Cerous salts are converted to the ceric form in mixed sulphuric-perchloric acids by the ozone treatment, and the ceric salt which is precipitated may then be dissolved in sulphuric acid and titrated against ferrous sulphate, using *o*-phenanthroline as indicator.

Halogens

Chloride may be determined in the presence of sulphide by simply precipitating the sulphide as copper sulphide, using copper sulphate as precipitate.¹⁶ The copper sulphide is then filtered off, and on making the solution acid with nitric acid, the halide may be determined in the usual fashion with silver nitrate. This method is also effective in the presence of hydrosulphide.

The estimation of bromide in brines by the method of van der Meulen¹⁷ is difficult, because the reaction concerned (oxidation to bromate by hypochlorite and iodometric estimation of the bromate) must be carried out at a definite pH range otherwise it is not quantitative, and it is not easy to maintain the process within this fixed range. The difficulty has been overcome by certain modifications.¹⁸ Using sodium acetate-acetic acid buffers, and testing the pH with a glass electrode, the range is maintained between 5.5 and 7.0 while the oxidation proceeds. The excess hypochlorite is then removed by addition of formate, allowing the iodometric determination of the resulting bromate to be carried out.

A catalytic reaction which is used on

the manufacturing scale has been proposed on a test for the iodide ion.¹⁹ In industry the oxidation of arsenious oxide by nitric acid is promoted by iodide. If, then, a drop of iodide solution is mixed with a drop of sodium arsenite solution, and the whole is treated with nitric acid, sodium arsenate will be produced, which is easily detected by the addition of silver nitrate. The red-brown silver arsenate will come down instead of yellow arsenite. The oxidation reaction is also catalysed by bromide, but only when this is present in much larger quantity. As a consequence, while 1 microgram of iodide can be detected by this reaction, amounts of the other halides up to 500 times this do not interfere.

It has been shown possible to estimate iodate in the presence of bromate and chlorate, using an ordinary iodometric titration.²⁰ That this is so arises from the fact that if a solution containing these ions is buffered carefully at *pH* 5 with potassium diphthalate, and treated

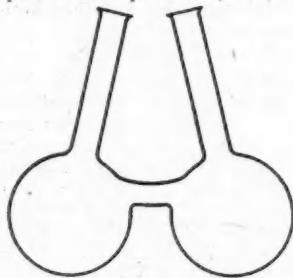


Fig. 1.

with hydrochloric acid and a small amount of molybdate (as a catalyst) the reaction of iodate is fast, while those of bromate and chlorate are so slow that any effect from them may be counted as inappreciable in the time necessary to carry out the titration.

The lime fusion method for halogens in organic compounds on the semi-micro scale²¹ has been shown to be satisfactory for bromine and iodine compounds.²² The authors who have carried out this investigation have suggested an ingenious method of testing the bomb used for the fusion for the presence of leaks, which might be applied in other directions. The bomb is half filled with solid carbon dioxide, sealed, and immersed in a

beaker of warm water. Considerable pressure is thus generated inside the bomb, and any leaks will indicate themselves by bubbles of escaping carbon dioxide. Instead of lime, sodium peroxide may be used in the bomb fusion method.²³ For the final part of the analysis it is stated that a gravimetric procedure is preferable to a volumetric.²⁴ The fusion product is treated with silver nitrate, any bromate or iodate which may have formed is reduced with hydrazine sulphate, and the silver halide filtered off. It is recommended that gelatine capsules be used for weighing out the samples, rather than glass, since the latter has a tendency to be transformed to soluble silicate, which may subsequently interfere by deposition of silicic acid.

Fluorine Detection

The detection and determination of the fluoride ion or of fluorine in organic compounds present problems which differentiate this element from the remainder of the halogens. A test for the detection of the ion, which is satisfactory in the presence of the other halides and of cyanide, and which therefore can be applied successfully to the solution obtained from a sodium fusion with organic compounds, has been devised by Simons and Ramler.²⁵ The reagent is cerous nitrate solution acidified with acetic acid, and it produces a precipitate of cerous fluoride which is insoluble in excess acetic acid, but soluble in strong mineral acids. Cerous nitrate has also been applied to the determination of fluorine in organic compounds.²⁶ The product from a micro-fusion with sodium peroxide is titrated against standard cerous nitrate solution, either electrometrically or using methyl red-bromocresol green as indicator. The electrometric method (with the glass electrode) is to be preferred, but a special titration device has been perfected to make the titration with the indicator more sensitive. This consists of two 100 ml. flasks joined together by a wide tube as shown in Fig. 1. The first part of the titration is carried out in one of the flasks, and on approaching the end-point the solution is divided equally between the two flasks and a drop of cerous nitrate is added to one of the flasks, with shaking. The colour difference between the two halves of the

solution is then noted; the portions are united and thoroughly mixed, and once again divided. This is repeated until a maximum difference is observed between the two portions on addition of a drop of the titrating liquid. This indicates that the end point has been reached. It is probable that this special vessel could be used in other titrations where the colour change is difficult to follow.

Saponification Number

An interesting principle has been applied by Rieman²⁷ in the determination of the saponification number of fats and oils, by the use of which it is possible to dispense with the usual blank determination, thus rendering greater accuracy possible, especially in the case of micro determinations, where exact measurements of small volumes of strong standard alkali are difficult. When the solution after saponification is titrated potentiometrically, a curve similar in general shape to that shown in Fig. 2 is obtained. The portion AB represents the acid corresponding to the excess potassium hydroxide, while the portion BC is a measure of the alkali actually used in the saponification, and hence the value desired in the determination. Since the inflection at C is very shallow, it is not normally possible to observe an indicator change here, and the usual method is to determine AB by one titration, and AC by another (the blank), finding BC by difference. Rieman has shown that if the amount of fatty acid in the solution is artificially decreased, it is possible to render the inflection at C steep enough to produce a sharp indicator change. The actual procedure as applied to the solution after saponification is as follows: on cooling, a considerable amount of phenolphthalein is added (actually 17 drops of 1 per cent. in the experiments described) and titration to the end point is carried out with N/2 hydrochloric acid. This corresponds to AB in the figure, and it is not necessary to know the amount of acid added. At this point 3 drops of brom cresol blue indicator are added, followed by 10 ml. of benzene, and the titration is continued. By simple partition the benzene serves to remove the fatty acid progressively from the solution, thus producing the conditions necessary for the titration BC to succeed. A colour change will be ob-

served some little time before the actual point C is reached, but by active shaking of the mixture this colour will revert

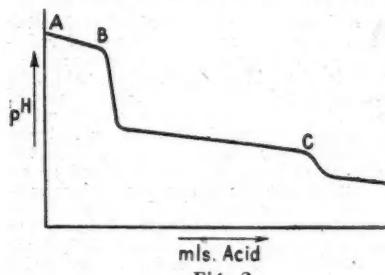


Fig. 2.

from yellow to blue, and the true end point is taken when the solution becomes green without returning to blue after shaking.

Identifying Plastics

Plastics in common use commercially may be usefully identified by a schematic method proposed by Nachamkin.²⁸ This, by utilising primarily the behaviour of the plastic on heating in a flame, i.e., the odour produced, whether the plastic burns, and the type of flame which it gives, enables the plastic to be allocated among seventeen groups which include over a hundred of the commoner commercial plastics.

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Dielectric Heating

A Potential Method for the Chemical Industry

AN important new technique of heating materials depends on the use of radio-frequency currents. In the ordinary way there is the difficulty that heat will flow from the outside to the centre of a mass of material only if a temperature gradient is established, so that the outside must always be made hotter than the centre when the temperature of solids is to be raised by an external source of heat. If the surface temperature has to be limited to avoid either chemical change or excessive fluidity, the rate of heat transfer is accordingly limited, and heating of a thick section is necessarily slow; this is particularly true of plastics and other substances which have a low thermal conductivity. Substances with a low thermal conductivity are usually also electrical insulators, and electronic technique has now overcome the difficulty of restricted heat flow, the heat being generated uniformly throughout the mass of material by the mechanism of dielectric loss in a high-frequency alternating electric field.

Principles Employed

The electrical engineer is accustomed to say that when an alternating voltage is applied to a condenser, an alternating current flows "through" the condenser, and although ideally there would be no dissipation of energy in the process, a condenser with a material dielectric does always dissipate some energy. The proportion of energy dissipated, compared with the product of the applied voltage and current, is specified by the "power factor" of the dielectric. This is a function of the material, but for any given material it varies with both frequency and temperature; it is zero for a vacuum, and for reasonably non-conducting liquids and solids ranges between 0.001 per cent. and 5 per cent. One source of dielectric loss is the polar molecule, which, having an electric moment, tends to move in the applied alternating field; the energy of molecular movement which occurs becomes random through collision with other molecules, *i.e.*, is dissipated as heat. For dielectric heating one naturally endeavours to use the frequency at which the power factor is greatest, and in polar substances this is fixed by a resonance depending on the moment of inertia of the molecule and the apparent viscosity of its surroundings; the dependence on a viscosity causes the critical frequency to vary with temperature. There are, however, other sources of loss and other considerations affecting the choice of frequency. For a particular capacity of condenser—which in practice means a particular lump of material to be heated by means

of a pair of electrodes placed on it—the high-frequency current flow at a given voltage increases in proportion to the frequency, and heat generated for a constant power factor increases as the square of the current.* There are practical limits to the voltage which can be applied, both to avoid elaborate insulation and safety precautions and because the potential gradient at the electrodes must not be sufficient to cause arcing which would char or otherwise damage the dielectric; beyond a certain point, more intense heating must be obtained by increasing the working frequency rather than the voltage.

There is, however, an economic limit to the raising of the frequency, which is set by the greater difficulty of generating energy when the frequency rises above 10 or 20 megacycles per second; this is due to increased losses in the oscillator circuit, the necessity for minimising lengths of connecting leads and the magnitudes of stray capacities, and eventually a limit is set to the frequency of ordinary valve oscillators by the time of transit of the electrons through the valve. The frequency generally used is between one and ten megacycles per second, which presents no difficulties on the electrical side.

The Valve Oscillator

The high-frequency power required may vary from a few hundred watts to 600 kilowatts, according to size of work to be heated (1 kW. is equivalent to 3.4 B.Th.U. per hour), and since exactitude of frequency and freedom from hum are not important, the very simple oscillator circuit of Fig. 1 can be employed. The radio-frequency voltage is generated by the two valves V_1 and V_2 , and the necessary high-tension power supply is obtained from alternating current mains via the step-up transformer T and rectifying valves V_3 , V_4 . The oscillator could be made to work without the rectifying valves and reservoir condenser C , but in that case it would only work during the positive half-cycles of the mains voltage, and the ratio of the mean power generated to the maximum voltage applied to the dielectric would be only a quarter of that with a steady maximum voltage; the extra complication of rectifying and partially smoothing the H.T. supply is therefore worth while.

With the types of valve available, it may be convenient to generate the radio-frequency power in the form of a higher voltage and smaller current than are required

* For applied voltage E at frequency f , the watts dissipated as heat in a condenser of capacity C and power factor δ are $W = 2\pi fCE^2\delta$

for dielectric heating; the coils L_1 and L_2 then operate as a step-down transformer at radio frequency, and at the same time isolate the output circuit from the high-voltage direct-current power supply which

for aircraft; in this case the electrodes are shaped to the contour of the propeller, and the more rapid "curing" obtained with uniform internal heating instead of externally applied heat is claimed to be an im-

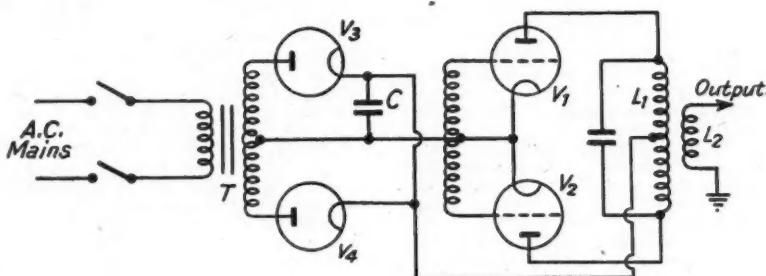


Fig. 1. Diagram of electric field heating circuit

feeds the oscillator valves. Although a single valve could be used, there are electrical advantages in using a pair of valves in a balanced circuit, and this will usually be preferable. To prevent radiation which would interfere with wireless communications, the following precautions are advisable:

- (i) Screen the oscillator.
- (ii) Include a filter (not shown in Fig. 1) in the H.T. power supply connection to the mains, to prevent radio-frequency currents from being transferred into the mains and so spread over a wide area.
- (iii) Keep leads between oscillator and work as short as possible, or screen them.
- (iv) High-power installations should be completely enclosed in a screened room.

Applications

The first application of dielectric heating seems to have been in drying tobacco without need to remove it from the hogsheads in which it was packed. Shortly afterwards it was used for killing weevils in grain; apparently insects have a much higher power factor than grain, so that when insect-infested grain is passed through a radio-frequency field the insects are burnt up but the grain is not affected. Now there are a number of industrial uses, to which prominence has been given by a symposium on the subject arranged by the Society of Plastics Engineers in Chicago on April 6 this year. Probably the first industrial application was for drying glue in plywood, and then for supplying the heat needed to polymerise the synthetic resin in resin-bonded plywood. The latter is one of the applications which is now receiving much publicity, because it has been used on laminated wood propellers

important factor in speeding up production. In producing ordinary flat sheets of plywood, the "live" electrode can be placed in the centre of a stack of sheets of plywood in the press, and the whole of the press framework is earthed and used for the other terminal of the condenser; the stack then forms two condensers back-to-back, one between the central electrode and the bottom of the press and the other between the central electrode and the top of the press.

Dielectric heating is also being used for plastic materials, particularly for thermosetting plastic mouldings of the type in which powdered material is pre-formed to the desired shape and then placed in a heated press to be brought to exact shape and polymerised. With the ordinary technique, the material must remain in the mould long enough for the heat to penetrate to the centre of the badly-conducting mass of powder, and high moulding pressure must be used because there is no stage at which the whole of the material is at the optimum moulding temperature. But it is now possible to place the powder "form" in a high-frequency field which heats the whole of it to about 150°C., when it is immediately put in a heated mould and maintained at that temperature until "cured." It is thus possible to shorten the time in the press, so that greater output can be obtained from a single mould, and as the pressure can be less the wear on the dies is reduced and less critical steels can be used in their manufacture. A power of 2 kW. per lb. is said to be sufficient to raise the temperature to 150°C. in one minute. It is not yet practicable to use dielectric heating inside the mould itself,

because this would necessitate insulating one-half of the mould from the other half.

The Radio Corporation of America has christened as "the electronic sewing machine" a device for welding seams in rubber or other thermoplastic materials. The edges to be joined are overlapped, and run through a machine which looks like a sewing machine, but which has in place of the needle a metal wheel above and below the seam; these two wheels form the two condenser plates of a dielectric heating system, and also provide sufficient pressure to unite the two surfaces as they become heated. In contrast to any method of external heating, the outer surfaces are no hotter than the inner surfaces which are to be fused together; they can in fact be kept much cooler through loss of heat to the air and to the metal wheels, so that the outside of the material remains sufficiently firm to be handled and not to stick to the machine while the inner faces are fused together.

Dielectric heating is firmly established as an industrial process in the United States, and will no doubt come into general use; perhaps when war-time secrecy is over we may hear of other uses which have already been found for it. But it should also be a valuable laboratory tool for the organic chemist, since it will allow rapid and uniform heating of solids and viscous fluids, which cannot be thoroughly stirred. Whether it will ever come into use in the domestic kitchen, where it could prevent food from being burnt on the bottom of the saucepan, for instance, is more problematical.

Spanish Chemical Industry New Factories and Extensions

AUTHORITY for the construction of new chemical works, and for the extension and alteration of existing plant, has been proceeding apace in Spain; and among the changes officially listed in a recent issue of *Ion*, the Spanish chemical journal, the following are of particular interest. At Saragossa, La Industria Química de Zaragoza is modernising its sulphuric acid production by the installation of a Lurgi contact plant, with a daily output of 10 metric tons of oleum. Barium salts (nitrate 50 tons, carbonate 50 tons, sulphate 50 tons, chloride 60 tons per diem) will be produced by Productos Electrolyticos, S.A., at Barcelona, in addition to an extended output of their general chemicals, while tungsten compounds are to be manufactured by La Atlántica S.L. at Villajuán (Pontevedra) at the following rates: sodium tungstate, 300 kg., ammonium paratungstate 200 kg., calcium tungstate 200 kg., trioxide and pentoxide 300 kg., and sponge tungsten 1 kg. A new factory for the production of synthetic

resins is to be established at Viladecans (Barcelona), while the celluloid factory of Alba y Gómez at Valencia will be extended to produce 300 kg. of synthetic camphor daily. Methyl bromide (1000 kg. per annum) and methyl chloride (500 kg. per annum) will be the output of the new company, Síntesis Española de Haluros Orgánicos, at Bilbao; another new concern is that of J. A. Ruiz of Madrid, which will produce 180 tons of sulphur annually. Among pharmaceutical products, sulphonamides will be manufactured by two Barcelona companies, Laboratorios "Fher" S.A., and Industrias G.M.B., S.L., each of which will turn out 100 kg. per month. Monplet y Esteban, S.A., Barcelona, are extending the scope of their manufacture to include (annually) 300 kg. phosphorus trichloride, 300 kg. phosphorus pentachloride, 600 kg. monochloroacetic acid, 750 kg. tertiary amyl alcohol, 600 kg. magnesium thiosulphate, 600 kg. calcium thiosulphate, 1500 kg. sodium thiosulphate, 1000 kg. magnesium chloride, 4000 kg. each of magnesium sulphate and sodium sulphate.

British Chemical Standards New Standardised Steels

BUREAU of Analysed Samples, Ltd., Markington, Harrogate, announces that the following new analytically standardised steel is ready for issue:—

B.C.S. MANGANESE-MOLYBDENUM STEEL

No. 214.

	%	%	
Mn	1.61	P	0.024
Mo	0.255	Cu	0.24
C	0.375	Ni	0.16
Si	0.24	Cr	0.06
S	0.033		

As usual, this steel has been analysed by a number of chemists representing independent analysts and several works chemists representing manufacturers of this type of steel. The above composition comes within the chemical specification for steel B.S. En.16-V 9A and will be found useful to chemists wishing to check the composition of steels made to this specification. In addition to the above, a replacement of nickel steel "T2" has recently been made, *viz.*, 3 per cent. Nickel Steel No. 222 (Ni 3.39 per cent.). Suppliers may be obtained through the usual chemical laboratory furnishers or direct from the Bureau.

The following new standards are in course of preparation: (i) Aluminium alloy No. 216, containing approx. Cu 4%, Mn 0.5%, Zn 0.2%, Mg 0.5%, Ni 0.2%, Ti 0.1%; (ii) Cr-Ni-Mo Steel No. 219, containing approx. Cr. 0.7%, Ni 3%, Mo 0.6%; (iii) High-speed tungsten molybdenum steel No. 220, containing approx. tungsten 6%, Cr 4%, V 1.3%, Mo 4.5%.

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Asbestos and its Products*

Progress in South Africa

THE most important variety of asbestos is known as chrysotile or white asbestos, which invariably occurs in some form of serpentine. The other asbestosiform minerals belong to what is known as the amphibole group of minerals, and include crocidolite or blue asbestos, amosite, tremolite, anthophyllite and actinolite. Chrysotile, crocidolite and amosite are the three principal varieties of asbestos fibre used in industry. Fibrous in character and capable of being spun and woven into fabrics in the same manner as cotton, asbestos possesses unique properties. It is incombustible, impervious to decay, resistant to chemical action, and is accordingly of great importance in the manufacture of a large variety of articles.

Publication of many of the facts regarding asbestos production has been suspended for the duration of the war. In 1938, the last year for which comprehensive statistics are available, the total world output amounted to 449,418 long tons, of which 262,600 tons were produced in Canada. The second largest producer was the U.S.S.R. with an output of 86,000 tons. Third and fourth on the list were Southern Rhodesia and the Union of South Africa, with respective totals of 53,352 and 20,199 tons. These four countries were in aggregate responsible for nearly 75 per cent. of the world output. The United States, with 11,703 tons, was the fifth largest producer, and in 1939 Swaziland entered the field as an important producer with an initial output of 7233 tons. Thus, the United Nations control all the world's major sources of asbestos.

Rhodesian Asbestos

Asbestos production in Southern Rhodesia seems to have originated mainly through the enterprise of Captain A. Heman, mining commissioner of the Victoria district, who sent various specimens of minerals for determination and analysis. The interest created by these specimens resulted in the pegging, in 1907, of Gath's mine in the Mashaba hills. The following year 55 tons of asbestos, valued at £550, were produced. Soon afterwards the King's mine, in the Mashaba area, was pegged. Many small workers embarked on the mining of asbestos, but it was a long time before they were able to find a market for their products in the United Kingdom. Not till the outbreak of the first world war did the output show any material increase. In 1915 it soared from 487 tons to 2010 tons. Five years later it reached 18,823 tons. Thereafter it mounted steadily to 42,634 tons in 1929. Southern Rhodesia then ranked as the world's

second producer of asbestos, taking all classes of fibre together, and was actually the largest producer of the better grades.

The world depression was severely felt by the Rhodesian asbestos industry, the output of which dropped in value from £1,070,847 in 1930 to £197,092 in 1932. By 1939, however, production had again risen in value to over £1,000,000 annually. Incidentally, two years ago it was reported that an asbestos products factory had been established at Gwelo to deal with asbestos from the mines at Shabani and Mashaba.

All Three Varieties

The Union of South Africa is unique among the asbestos-producing countries of the world in that it can supply all the three commercial varieties of fibre, and it is the only country in the world which produces amosite and blue asbestos in commercially important quantities, though recent advices indicate that Western Australia is coming into the picture. It is noteworthy that blue asbestos was first "discovered" in South Africa in 1816; the name crocidolite, meaning flaky stone, was applied to it in 1831. Amosite was first known in 1907; the name (given it in 1918) being taken from the initials of the company chiefly interested in its production—Asbestos Mines of South Africa. Incidentally, the Cape Asbestos Company were the original spinners of crocidolite—as early as 1895.

Chrysotile occurs in Swaziland and the Eastern Transvaal; also in Natal and in serpentinized dolomites near Carolina. Crocidolite occurs in Griqualand West, and in the Pietersburg district, Transvaal. Amosite is found along the Olifants river between Chuniespoort and the Steelpoort river. The most important fibre zone worked is at Penge; the middle seam here, which is the main source of asbestos, yields fibre which averages from 8 to 9 inches with a maximum of 12 inches.

The first consideration in mining asbestos is to damage the fibres as little as possible. In Rhodesian quarries this is effected by separating most of the fibre from the rock as near to the working face as convenient, and by blasting short lightly charged holes. Winzes are sunk in rows about 50 feet or 60 feet apart, connecting each way with crosscuts on the level below. These winzes are kept nearly full of broken rock and the ground is stoned out round them, the fibre being cotted and bagged, and the rock thrown into the winzes. In order to facilitate capping, the floor of the quarry is kept fairly flat and as free as possible from broken rock, a certain amount of "lashing" or mucking into the winzes being necessary. Overburden is removed in a similar manner to the ore, but is trammed

* Condensed from an article in *The South African Mining and Engineering Journal*, June 5, 1943, p. 293.

and hoisted up separate overburden shafts. In mining an asbestos deposit certain considerations not common to metal mining are introduced. Of these, one of paramount importance is that the fibre dispatched must not contain foreign matter. Further, mining methods must be such that cognisance is taken of the physical characteristics of the deposits. The lode boundaries are irregular, for the hanging-wall is an economic wall, while the footwall is an ill-defined contact zone between strong silky fibre and brittle glassy fibre. As the quarries reach depth, the heavy cost of removing the hanging-wall overburden made this method prohibitive. Stoping is carried out by a modified flatback cut-and-fill method. A stope may be any length on the strike, and both ends are usually where some interference has occurred, such as a squeezing-out of the payable fibre, and is divided into panels, sometimes up to as many as 28 in one stope.

The Havelock mine, situated just across the Transvaal border in Swaziland, is the latest undertaking of the great overseas asbestos group, Turner & Newall, Ltd., a concern with subsidiary companies in Britain, Canada, the United States and Southern Africa. No less than £750,000 was expended in bringing the Havelock proposition to the producing stage. Production of asbestos was begun in June, 1939, and the plant is now capable of producing more than 2000 tons of bagged asbestos monthly. At the annual general meeting of Turner & Newall, Ltd., in January last year, it was announced that a new method of milling raw asbestos had been evolved and operated with great success. This new method is regarded as of such importance that patent protection has been applied for in all the principal asbestos mining countries in the world.

Chrysotile

Chrysotile is the type of asbestos fibre most commonly used in industry for asbestos textiles, brake linings and clutch facings, packing and insulation products, asbestos board, asbestos cement products, etc. It has the property of separating into fibres of exceedingly fine diameter. Good chrysotile withstands temperatures of from 2000° to 3000°C. without fusing, but loses some of its water of crystallisation and becomes brittle at a lower temperature. It is a poor conductor of heat and electricity. The spinnability of chrysotile is determined by the length of the fibre, its fineness, flexibility, resistance and tensile strength. The value of chrysotile asbestos depends largely on the length of the fibre. The most important principle underlying the milling of asbestos, therefore, is the separation of fibre from rock with minimum breakage of fibres. The best machines spare the fibres unnecessarily rough treatment, and at the same time break the rock effectively. Modern mills are designed to remove the

separated fibre after each crushing process, to separate the sand as soon as it is formed, and to keep hard barren rock out of the mill. Asbestos milling consists essentially of coarse crushing, drying, and recrushing in stages, each step being followed by screening and air separation of fibre from rock.

The ore from the mine is roughly sorted, and when reasonably dry is crushed with large crushers down to about 1 in. The ore is then passed over sorting belts, the waste sorted out, and also long thin fibre veins, which are put to one side for special fine weaving. The balance is conveyed to rotary driers and thence to the actual reduction plant, consisting of rolls and crushing mills. It is next passed automatically to graders, where it is sorted and the fibre is separated by air suction and bagged. It is then ready for dispatch to the factory. On arrival at the factory, the fibre is put through an opener, which further loosens and sorts it. Some of it is then passed to a scutcher, where it is combed and drawn and finally emerges as a loose rope on a bobbin. This yarn is a semi-manufactured product, and is used, *inter alia*, to make cloth. For this purpose it is taken to a loom, where it is woven like ordinary cotton or woollen cloth.

Crocidolite

Crocidolite is blue in colour, varying in shade. Its tensile strength is greater than that of chrysotile, and it withstands sea water better, but fuses at a lower temperature. At moderate temperatures it has superior insulating properties to other types of asbestos. It is used principally in the manufacture of filter cloth, boiler mattresses, felted insulation blocks, sectional steam pipe coverings, high pressure asbestos cement pipes, etc. It is graded according to quality and length.

Methods of milling and grading crocidolite vary greatly in different localities. At the smaller workings the fibre is all hand-cobbed. It may then be hand-sorted into grades according to length or graded by machinery. The cobbed fibre from a series of workings may be shipped to a central screening plant, where all asbestos $\frac{1}{2}$ in. long or over is recovered, the minus $\frac{1}{2}$ in. product being taken to a mill for further crushing and grading. A number of different grades are produced. Of the total fibre recovered, about 13 $\frac{1}{2}$ per cent. is hand-cobbed and 86 $\frac{1}{2}$ per cent. milled. In both the Northern and Southern Belts about 9 per cent. of the total fibre is of spinning grade.

Amosite

Because of its unusual length, most of the amosite produced is hand-cobbed. The fibre thus freed from adhering rock is passed through a series of rolls and disintegrators and then graded on shaking screens or trommels, usually into three grades. No. 1 is spinning fibre; No. 2 is used in the manufacture of

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rope, felts and similar products; and No. 3 is used for asbestos-cement products. The fibre is classified mainly according to colour and quality. The latter is not on the whole so fine as that of chrysotile, but its tensile strength and resistance to acids and sea water are superior. Amosite fuses less readily than crocidolite, but in other respects is very similar to blue asbestos in its qualities, namely, high resistance to acids and excellent insulating properties. It is unsurpassed in the natural length of fibre, and at the same price can always be obtained in longer lengths than any other asbestos. The best grades sold are from 1½ in. upwards in length, of ash grey colour, and of good tensile strength.

Ancient and Modern Uses

Asbestos was known many centuries ago to the Egyptians and the Chinese. Samples of shrouds and tablecloths of asbestos used by the ancient Romans are reputed to be in the Museum of the Vatican. The Romans considered asbestos to be a product of the organic world, but recognised its resistance to heat, wrapping their dead in it for cremation and so facilitating the segregation of the human remains from the ashes in the fuel. Plutarch refers to its use for wicks of oil lamps, which were apparently a product of Cyprus. Among the most important modern developments is the use of asbestos clothing, which has reached a stage where it is possible to obtain suits in which the wearers can remain for one and a half to four minutes in the midst of fires of great intensity. The arrangement of a cold air feed to the helmet on the lines of a smoke helmet appreciably prolongs the practical time of use for the equipment.

The value of asbestos as a heat insulator is of tremendous importance to commerce and industry. Asbestos firecloth curtains provide a more efficient bulkhead or fire stop than an ordinary thin metal fibre door. Fires in ordinary commercial buildings tend to spread upwards. Asbestos fireboard, alone or in combination with asbestos felts, provides a fire bulkhead capable of preventing the ignition of inflammable material in the form of joists or floor boards above them for considerable periods. In factories with oil-fired muffle furnaces, large petrol or naphtha storage, etc., asbestos materials provide an efficient and economical means of fire protection.

The ever-expanding uses to which asbestos fibre is being put, together with the wide distribution of this material throughout the sub-continent, have led to the establishment in the Union of industries which are playing a vital part in national industrial development. A striking indication of the wide range of commodities covered by the term "asbestos products" is provided by the activities of Cape Asbestos Insulations (Pty.), Ltd., which this company has established a factory for the manufacture of many types of product from asbestos mined in South Africa.

So numerous are the types of product made from asbestos cement that this branch of manufacture may be regarded as an industry in itself. The history of this South African development goes back to the last war, when asbestos-cement ceiling sheets were manufactured in a small way by a Durban firm. At that time many architects were prejudiced against asbestos-cement roofing, and it was a hard struggle to get this product established. However, when the Public Works Department and the South African Railways commenced specifying this material, prejudice gradually died away. Asbestos cement has proved an ideal roofing material—particularly for coastal areas—in South Africa.

During the past 25 years there have been probably a dozen different types of ceiling boards, sheets or plates put upon the market. Many proved unsuitable for the climate, others are still in use. Asbestos-cement ceilings have proved particularly successful, their chief feature being that they are not affected by atmospheric conditions and do not harbour insects or vermin.

Asbestos-cement products are manufactured in South Africa on a substantial scale by Everite (Pty.), Ltd., and by the Asbestos Cement Manufacturing Co., Ltd., and recently the manufacture of asbestos-cement products has also been started at Roodepoort by Super-concrete Pipes (S.A.), Ltd.

Products at present being manufactured include corrugated sheets and accessories for roofing, flat sheets, rainwater goods and fittings, soil pipes and connections, flue pipes, electric cable conduit and troughs, ventilating ducts and ventilators, and moulded goods of all descriptions, as well as articles for domestic use. Work is in progress on the erection of a plant to manufacture asbestos-cement pressure pipes.

Asbestos-Cement Manufacture

The following is a brief description of the main features of the process employed in the manufacture of asbestos cement at the factory of Everite (Pty.), Ltd. :—

The asbestos fibre, when received from the mines, requires further treatment before it is ready to use for the manufacture of asbestos-cement products. From the raw-material store it passes to the preparation floor, where it is passed through the crushing mill and disintegrating machine. By this time the fibre is thoroughly cleaned and separated. It is then blown by means of fans through tubes to the asbestos fibre storage silos. It is now carefully weighed and the required quantity placed in the "Hollander" or mixing tank, consisting of an elliptical trough in which rotates a large drum fitted with steel blades. At this stage water is added to the fibre, which travels round the elliptical trough and under the mixing drum several times. The cement is then added, and the mixture

continues to circulate until each individual fibre is thoroughly coated with cement.

From the "Hollander," the mixture passes to a large tank, where it is continually stirred and agitated until required for further use. It then passes through various devices which eventually deposit it on an endless travelling felt belt in a thin, evenly distributed layer. By this time most of the water has been squeezed out of the mixture, this process being completed when the belt passes over a vacuum box in which the negative pressure is carefully controlled. The mixture on the belt then passes under a heavy roller, which picks up a thin layer of semi-dry asbestos cement and continues to do so until the required thickness has been built up on the roller. The operator then cuts through the sheet, which falls on to a conveyor.

Finishing the Sheets

The fibres of asbestos have been so thoroughly felted by the foregoing process that the sheet, which is now in a condition similar to that of a wet blanket, can either be formed into a corrugated sheet or flat sheet, or alternatively can be rolled up and conveyed to where it is required, unrolled and formed on moulds to an almost unlimited variety of shapes. It remains only for the cement to set so that the corrugated sheets, flat sheets or moulded articles will retain their shape.

During the existing shortage of steel and other building materials, asbestos-cement products are helping to solve many critical problems of supply. After the war the industry should be in a position to take full advantage of the favourable conditions for expansion which can confidently be anticipated.

New Control Orders

Coal Distribution

THE Coal Distribution Order, 1943, which will come into force on September 1, modifies the provisions of the Fuel and Lighting Registration and Distribution Orders, regulating coal supplies to controlled premises. The Order prohibits, except as may be authorised by licence or for resale, the keeping at any controlled premises of coal which has not been lawfully acquired for actual consumption in those premises. The revised definition of controlled premises has been revised and now covers (1) all non-industrial premises, and (2) all industrial premises which in the year ended June 30, 1943, consumed not more than 100 tons of coal. Coal for this purpose includes coke, anthracite, and manufactured fuels of which coal, coke, or anthracite is the principal constituent. Copies of the Order, including a brief statement of the main changes, will shortly be available from H.M. Stationery Office (price 6d. net) or through any bookseller.

Scotland's Lime Output

Target Over 200,000 Tons

REPLYING to the memorandum upon the need for greater development of Scotland's resources in lime supplies, sent to him by the Scottish Reconstruction Committee, the Secretary of State for Scotland expresses the hope that Scottish production of higher-grade lime will reach a figure of well over 200,000 tons for 1943-44. Such an output would represent an increase of 120 per cent. over pre-war.

"So far as the industrial use of lime in Scotland is concerned, I am doubtful," writes Mr. Johnston, "whether it will be practicable to effect any material change in the sources of production. Limes produced in Northern England are intrinsically better, and economically cheaper, than most of the limes produced in Scotland, and it follows that, at least for industrial use in Scotland, the Northern English limes will continue to command the market. The position may be different in, say, the case of paper mills in Aberdeen, where, I understand, there may be scope for the use of limes from Banffshire. But—and this fact is of even greater importance—in England (apart from industrial uses) considerable quantities of limestone are used as road materials. That does not hold in Scotland because of the availability of whinstone in most districts. Taking these two facts regarding industrial lime into consideration, the economics of the Scottish production, which must be used primarily for agriculture, become a difficult problem. But I do not think that it is insoluble, or that, if we are to have a balanced agriculture, we can afford to neglect the many deposits of good limestone which still lie undeveloped."

The *Glasgow Herald* reports that within recent months new sources of agricultural lime have been developed. An excavator and screening plant has been set up to deal with the shell-sand at John o' Groats, Caithness, and production is substantial. A new plant capable of producing 12,000 tons a year has been started near Blairgowrie to work the Loch Tay deposit there, and efforts are being made to get progress made in the extensive use of the deposits in Banffshire.

MR. WILLIAM LEE, until recently a member of the executive of Boots Pure Drug Company, Ltd., has been elected a member of the Notts County Council.

The following officials of the Chemical Council have been re-elected:—DR. LESLIE H. LAMPITT (chairman), MR. KENNETH H. WILSON (vice-chairman) and DR. A. E. DUNSTAN (hon. treasurer). DR. R. E. SLADE has been appointed hon. secretary.

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Personal Notes

MR. STANLEY DIXON, who has been secretary of The Midland Tar Distillers, Ltd., for the past eight years, has been appointed to a seat on the board in place of the late Mr. Herbert Bairstow.

PILOT-OFFICER J. L. EDWARDS, formerly a member of the laboratory staff of the Anchor Chemical Co., Ltd., has been reported missing from operations, and it is feared that he has lost his life.

MAJOR T. C. CLABBURN, Gurkha Rifles, who has been awarded the M.B.E., was before the war on the staff of the Anglo-Iranian Oil Company at Abadan. Previously he was with the National Oil Refineries, Llandarcy, Swansea.

MR. THOMAS J. DOUGHTY, a student at Widnes Technical College, passed first in order of merit in the whole of the area of the Union of Lancashire and Cheshire Institutes in the advanced chemistry course first-year examination.

MR. T. G. DAVIDSON, who has retired after 63 years in the ink manufacturing trade, was presented with a cheque in appreciation of his services with Douglas Stott & Co., Ltd., Edinburgh, by Mr. T. L. McCall, one of the directors, on behalf of the firm, of which he had been manager since 1927. Mr. Davidson served his apprenticeship in the laboratory of A. B. Fleming & Co., Ltd., Granton, continuing in their employment for over 15 years, and from 1899 to 1927 he was with the Richardson Printing Ink Co., Ltd., Gateshead, rising to the position of director.

SIR CLIVE BAILLIEU, K.B.E., C.M.G., who has been appointed Deputy President of the Federation of British Industries, is resigning from his position as the British member of the Combined Raw Materials Board and Head of the British Raw Materials Mission in Washington. He will assume the presidency at a later date if the members accept the recommendation of the Council that he should be nominated for that office. Sir Clive Baillieu is director of the British Metal Corporation, the Imperial Smelting Corporation, and many other companies. Mr. WILLIAM BATT, the American member of the Combined Raw Materials Board, will accompany Sir Clive to England.

Obituary

MR. LEWIS SENIOR, M.Sc., late chemistry master at Batley Grammar School, died on August 21 at Batley, Yorks.

MR. CYRIL ASTILL, senior director of Messrs. Newball and Mason, Ltd., manufacturing chemists, of Basford, Nottingham, has died, aged 61.

The death is reported of **MR. FRANK H. FULFORD**, for 37 years managing director of C. E. Fulford, Ltd., manufacturing chemists, of Leeds. He was 75.

The death is announced of **MR. FREDERICK WINSTANLEY MODY**, managing director, since the incorporation of the company, of Mody and Co., Ltd., varnish manufacturers, Manchester.

MR. J. H. DUNFORD, who died recently at West Bridgeford, Nottingham, aged 73, was secretary, and then managing director of Hall's Glue and Bone Works. He had been a member of the local committee of the Society of Chemical Industry.

SIR JAMES MORTON, who died at Dalston Hall, near Carlisle, on August 22, aged 76, was one of the outstanding figures in the development of the British dyesuffs industry. He was the first to produce dyed fabrics fast to sunlight, and, at the beginning of the last war, started the first manufacture of anthraquinone dyestuffs in Britain. This led to his founding Scottish Dyes, Ltd., a company since incorporated in Imperial Chemical Industries. He was chairman of Morton Sundour Fabrics, Ltd., and of Standfast Dyers and Printers, Ltd. Sir James was the first recipient of the Faraday Centennial Medal "in special recognition of signal service rendered to chemical science and industry," and in 1929 he was awarded the medal of the Royal Society of Arts for his lecture on the History of Fast Dyes. He was knighted in 1936 for his services to the dyesuffs industry and was an LL.D. of St. Andrews University.

MR. FRANK FORSTER RENWICK, F.I.C., hon. F.R.P.S., F.C.G.I., research director of Ilford, Ltd., died on August 14 at Gidea Park, Essex, after a short illness, at the age of 66. He studied under H. E. Armstrong at the "City and Guilds," and was awarded an Institute Scholarship and the Leather-sellers' Research Fellowship. Doubtless the influence of Armstrong directed him towards chemistry; his association with Ilford, beginning in 1898, started on the chemical side, and in the next 45 years he made many important contributions to photographic chemistry. Only recently he brought into being the well-known photographic products, "Multigrade" and "Kryptoscreen." He became F.I.C. in 1918, and in 1920 he was largely responsible for creating the scientific and technical group of the Royal Photographic Society, with whom he had long been closely in touch. In 1922-25 he directed the Redpath Laboratory of the Du Pont Film Manufacturing Corporation, at Parlin, N.J., an experience which aided him in building the Ilford research organisation in this country. He received many photographic honours, British and foreign, and he was president of the R.P.S. in 1927-29.

Prices of British Chemical Products

TRADING conditions in the London general chemicals market are now reverting to normal after a few quiet weeks due to the holiday period, and a slight increase in new business is reported. Values throughout the market remain firm. In the soda products section the majority of items are quoted at strong rates, bichromate of soda, yellow prussiate of soda, and chlorate of soda being called for in fair quantities, while a moderate trade is passing in caustic soda and hyposulphite of soda. Offers of yellow prussiate of soda continue scarce. Among the potash products, permanganate is firm and in good request, while supplies of both caustic potash and bichromate of potash are none too plentiful. Acid phosphate of potash remains steady. In other directions acetone, powdered arsenic and peroxide of hydrogen are all good markets, while the demand for formaldehyde has been well maintained. Activity in the coal-tar products market is fairly brisk and there is a good call for creosote oil, carbolic and cresylic acids, and the tolouls. Pyridine and pitch are receiving a moderate inquiry.

MANCHESTER.—Firm price conditions continue to be indicated in almost all sections of the Manchester chemical market, the actual movements have been few. To some extent, holiday influences are affecting both new business and the movement of contract supplies, though this factor has been less in evidence than during the past month or so. Soda compounds are mostly meeting with a steady flow of contract delivery specifications, and offers of the potash materials are finding ready outlets, while a fair call for deliveries of the ammonia and magnesia products, as well as the acids, is reported. Most descriptions of tar products, both light and heavy, are being taken up satisfactorily.

GLASGOW.—In the Scottish heavy chemical trade there is no actual change during the past week. Home business continues steady, while export trade is still rather restricted. Prices remain very firm with no actual changes to report.

Price Changes

Rises: Arsenic.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton £39 10s.; 10 cwt./1 ton, £40 10s., 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from rice control.

Alum.—Loose lump, £16 per ton, f.o.r.

Aluminium Sulphate.—£11 10s. to £11 15s. per ton d/d.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Carbonate.—£38 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac. •

Antimony Oxide.—£111 to £117 per ton.

Arsenic.—For 1-ton lots, £43 to £45 per ton, according to quality, ex store. Intermediate prices for intervening quantities.

Barium Carbonate.—MANCHESTER: precip. (4-ton lots), £16 per ton d/d.

Barium Chloride.—98/100%, prime white crystals, £17 10s. to £19 10s. per ton, bag packing, ex works.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax, Commercial.—Granulated, £31 10s.; crystals, £32 10s.; powdered, £33; extra fine powder, £34; B.P. crystals £40 10s.; powdered, £41; extra fine, £42 per ton for ton-lots, in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £83; powder, £84 per ton in tin-lined cases for home trade only, packages free, carriage paid.

Boric	15s.
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Boric Acid.—Commercial, granulated, £52 15s.; crystals, £53 15s.; powdered, £54 15s.; extra fine powder, £56 15s.; B.P. crystals, £61 15s.; powdered, £62 15s.; extra fine powdered, £64 15s. per ton for ton lots in free 1-cwt. bags, carriage paid in Great Britain.

Calcium Bisulphite.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£10 10s. to £14 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5½d. per lb.

Chromic Acid.—1s. 5d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6d.; other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d.; other, 1s. 7d. Higher prices for smaller quantities.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£31 5s. per ton, f.o.b., less 2 per cent. in 2 cwt. bags.

Cream of Tartar.—100%, £14 7s. per cwt., less 2½%, d/d in sellers' returnable caisks.

Formaldehyde.—£24 10s. to £26 per ton in casks, according to quantity, d/d. MANCHESTER: 40%, £24 10s. to £26 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £47 per ton for ton lots, carriage paid; smaller parcels quoted up to 50s. per cwt., ex store.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 6s. 5½d. to 8s. 11d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £49 per ton; dark tech., 43½% by weight, £42 per ton ex works; barrels returnable carriage paid.

Lead Acetate.—White, 50s. 6d. to 52s. 6d. per cwt. MANCHESTER: £51 to £54 per ton.

Lead Nitrate.—About £47 per ton d/d in casks.

Lead, Red.—English, 5/10 cwt., £44 10s. per ton; 10 cwt. to 1 ton, £44 5s.; 1/2 tons, £44; 2/5 tons, £43 10s.; 5/20 tons, £43; 20/100 tons, £42 10s.; over 100 tons, £42 per ton, less 2½%, carriage paid, non-setting red lead, 10s. per ton dearer in each case.

Lead, White.—Dry English, less than 5 tons, £57; 5/15 tons, £53; 15/25 tons, £52 10s.; 25/50 tons, £52; 50/200 tons, £51 10s. per ton; less 5%, carriage paid. Ground in oil, English, 1/5 cwt., £69; 5/10 cwt., £68; 10 cwt. to 1 ton, £67 10s.; 1/2 tons, £66; 2/5 tons, £65; 5/10 tons, £63; 10/15 tons, £62; 15/25 tons, £61; 50/100 tons, £60 10s. per ton, less 5% carriage paid.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride.—Solid (ex wharf), £16 to £18 per ton. MANCHESTER: £15 to £17 per ton.

Magnesium Sulphate.—Commercial, £12 to £14 per ton, according to quality, ex works.

Mercury Products.—Controlled price for 1 cwt. quantities: Bichloride powder, 15s. 8d.; bichloride lump, 16s. 3d.; mercury oxide, red cryst., 20s. 9d.; red levig., 20s. 3d.; red tech., 19s. 11d.; yellow levig., 20s. 2d.; yellow tech., 19s. 7d.; sulphide, red, 17s. 9d.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£60 to £65 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Potash, Caustic.—Basic price for 50-100 ton lots. Solid, 88/92%, commercial grade, £53 7s. 6d. per ton, c.i.f. U.K. port, duty paid. Broken, £5 extra; flake, £7 10s. extra; powder, £10 extra per ton. Ex store, £3 10s. supplement. Liquid, d/d, £34 in lots of 1 ton.

Potassium Bichromate.—Crystals and granular, 7½d. per lb.; ground, 8½d. per lb., for not less than 6 cwt.; 1-cwt. lots, 1d. per lb. extra.

Potassium Carbonate.—Basic prices for 50 to 100 ton lots; calcined, 98/100%, £52 10s. per ton, c.i.f. U.K. port. Ex warehouse, £55 5s. per ton.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 10d. per lb. for 1 cwt. lots; for 3 cwt. and upwards, 1s. 9d. per lb.; technical, £7 18s. 6d. to £8 10s. 6d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, 5 cwt. to 7 cwt., casks, 1s. 6d. per lb., d/d; supplies scarce.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic.—Solid 76/77%; spot, £16 7s. 6d. per ton d/d station.

Sodium Acetate.—£41 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 6½d. per lb., net, d/d U.K.

Sodium Bisulphite Powder.—60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£21 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, d/d, according to quantity.

Sodium Hyposulphite.—Pea crystals, £21 10s. per ton for 2-ton lots; commercial, £15 per ton.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metasilicate.—£16 per ton, d/d U.K. in 1-ton lots.

Sodium Nitrite.—£20 to £23 10s. per ton for ton lots.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 to £28 10s. per ton d/d for ton lots. Tri-sodium, £26 to £30 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salts).—£4 10s. ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 1ls. per ton d/d station in bulk. MANCHESTER: £4 15s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £18 5s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton, for quantities of not less than 4 tons; ground, but not sieved, £15 10s.; ground and sieved, £17 15s. Controlled prices.

Sulphuric Acid.—168° Tw., £6 10s. to £7 10s. per ton; 140° Tw., arsenic-free, £4 1ls. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—3s. 4½d. per lb., less 5%, carriage paid for lots of 5 cwt. and upwards.

Tin Oxide.—Snow-white, controlled material, about 330s. per cwt.; free (nominal), 400s.-500s. per cwt.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £34; green seal, £38; red seal, £31 10s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Bisulphide.—£34 per ton, according to quality, in free returnable drums.

Carbon Tetrachloride.—£46 to £49 per ton.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 6 3/16d. to 10 1/4d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—90%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 16s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton d/d farmer's nearest station, in September, £20. Increased charge of 2s. 6d. per month up to March, 1944.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, August, £9 10s.; increased charge of 1s. 6d. per month up to March, 1944.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, in September: I.C.I. type "Special No. 1," £14 6s. 6d. Increased charge of 2s. 6d. per month up to March, 1944. Type "Special No. 2," none available until January, 1944.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £15 5s. per ton; granulated, over 98%, £14 10s. per ton. Surcharges for smaller quantities unless collected at warehouse or depots.

Coal Tar Products

Benzol.—Crude, 60's, 1s. 11d.; pure, 2s. 6d., per gal., ex works.

Carbolic Acid.—Crystals, 9½d. to 11½d. per lb. Crude, 60's, 4s. 3d. to 4s. 6d., according to specification. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. to 4s. 6d., naked, at works.

Creosote.—Home trade, 6½d. per gal., f.o.r., maker's works; exports, 6d. to 6½d. per gal., according to grade. MANCHESTER: 6d. to 9d. per gal.

Gresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. MANCHESTER: Pale, 99/100%, 4s. 6d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 8d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 2d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, in 4-ton lots, in sellers' bags, £5 9s. to £8 9s. per ton, according to m.p.; hot-pressed, £10 5s. per ton, in bulk ex works; purified crystals, £19 to £35 per ton. Controlled prices.

Pitch.—Medium, soft, 46s. to 55s. per ton, f.o.b. MANCHESTER: 46s. per ton, at works.

Pyridine.—90/140°, 18s. to 18s. 6d. per gal.; 90/160°, 14s. MANCHESTER: 14s. to 18s. 6d. per gal.

Toluol.—Pure, 2s. 7½d. nominal; 90's, 1s. 11d. per gal. MANCHESTER: Pure, 2s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 1½d. to 3s. 4d. per gal., according to grade, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p **Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—August 25.—For the period ending August 28, per ton, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies: LINSEED OIL, crude, £50. RAPESEED OIL, crude, £60. COTTONSEED OIL, crude, £39 12s. 6d.; washed, £42 15s.; refined edible, £57; refined, deodorised, £58. COCONUT OIL, crude, £36 12s. 6d.; refined deodorised, £49. PALM KERNEL OIL, crude, £36; refined deodorised, £49; refined hardened deodorised, £53. PALM OIL, refined deodorised, £55; refined hardened deodorised, £58. GROUNDNUT OIL, crude, £44; refined deodorised, £58. WHALE OIL, crude hardened, 42 deg., £39; refined hardened, 42 deg., £51. ACID OILS—Groundnut, £27 10s.; soya, £25 10s.; coconut and palm-kernel, £31. ROSIN, 28s. 6d. to 43s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

General News

The Pharmaceutical Society's College of Pharmacy is returning to London next month.

The Rubber Control announce a reduction in the price of Thiokol FA from 3s. 3d. per lb. to 2s. 6d. per lb. delivered, with effect from August 23.

Mr. Thomas McLachlan, F.I.C., public analyst and official agricultural chemist, has removed his laboratory to 4 Hanway Place, Tottenham Court Road, London, W.1 (Tel. MUSEum 4501).

The Control of War Emergency Paint Order (S.R. & O. 1943, No. 1183), which came into force on August 16, fixes the price of the War Emergency Paint which is now being made in limited quantities.

The Archbishop of York included a visit to a Middlesbrough chemical works in his tour of that town last week. Dr. Garbett spoke to many of the workers and the processes were explained to him.

A broadcast talk on Lavoisier will be delivered in the Home Service of the B.B.C. on Sunday, August 29, by Sir Harold Hartley, C.B.E., F.R.S., M.C., himself a distinguished chemist, and vice-president of the L.M.S.

Samples of sugar beet taken in North Lincolnshire reveal that the sugar content of the forthcoming crops is likely to be much better than last year. To date there is an increase in sugar content of over 2 per cent., and the average weight of roots is 37 grammes higher.

Common salt as a fertiliser for sugar beet is being tested at farms and research stations all over England. According to a report in *Farmers' Weekly* more sugar was obtained per acre by applying 5 cwt. of sodium chloride than by applying 2.5 cwt. of potassium chloride.

Special training courses in electric and oxy-acetylene welding are among those arranged by the Ministry of Labour for disabled merchant seamen. Weekly allowances are paid to persons in training, and courses in other occupations beyond those listed can be arranged if necessary.

The Society of Public Analysts has been considering the possible danger of the incidence of comparatively large quantities of fluorine in foodstuffs containing acid phosphates, and has published the following provisional standards pending any official regulations by the Ministry of Health. The proportion of fluorine, however combined, should not exceed: in acid phosphates, 200 parts per million; in baking powder, 70; in golden raising powder, 50; in self-raising flour, cake mixtures and like compositions, 5. It is recommended that no action should be taken under the Food and Drugs Act where these quantities are not exceeded.

From Week to Week

The Canadian authorities have decided, as a war-time measure, to close the office of the Canadian Government Trade Commissioner in Bristol. After September 1, therefore, any communications for that office should be addressed to the Canadian Government Trade Commissioner, Martins Bank Building, Water Street, Liverpool.

Foreign News

Lead mines at Arjeplog in Swedish Lapland are producing 15,000 tons of ore a year.

Platinum exports from Colombia last year amounted to 1530 kg., the largest quantity handled in the last nine years.

The chemical works at Leverkusen, north of Cologne, were bombed by the R.A.F. on Sunday night.

An R.A.F. raid last week-end started fires in a chemical factory near the marshalling yards of Cotrone, Southern Italy.

Annual asbestos output of Bulgaria has reached the value of 312,000,000 levas (about £250,000).

Synthetic caffeine for medicinal purposes is being produced in a factory in Poland from uric-acid compounds on the basis of a method developed in 1895.

American experts are assisting Mexico to produce more agar-agar, needed for the production of antitoxins with which U.S. fighting men are inoculated.

A plant near Chungking is making tetraethyl lead to be added to petrol from China's oilfields, which will soon be yielding a million gallons of refined petrol a day.

The Swedish company Boliden Gruv A/B, at the urgent request of the Government, is enlarging its plant to increase copper, lead, and nickel production.

America's War Production Board has announced the formation of a special advisory committee for the molybdenum industry.

Demand for compressed gases for welding has increased in Canada. Last year 105,742,000 cu. ft. of acetylene were made, a 29 per cent. increase over 1941. Oxygen output jumped 45 per cent., to 522,571,000 cu. ft.

The nickel-mining centre of Pomelaa, on the Dutch East Indian island of Celebes, now in Japanese hands, was raided by American planes last Saturday. The Japanese used to buy nearly all the nickel ore produced in this district, amounting to 6000 tons a year.

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Sweden's iron and steel supplies are expected to be increased this autumn when the 20,000,000-kronor plant of the Lulea Iron Works begins operations, with an annual capacity of 60,000 metric tons of pig iron.

A new food yeast is being produced by a firm of St. Louis brewers and sold to the U.S. Army and Lease-Lend administration. A brownish powder, it is said to be twice as rich in protein as meat.

Charcoal from bagasse and vacuum-pan molasses is to be made in Barbados. Production costs amount to only \$19.5 a ton, less than half the price at present paid for imported charcoal.

Canada's fertiliser production last year was valued at \$20,005,585, and included 391,000 tons of mixed fertilisers, and 280,000 tons of superphosphate, synthetic ammonium sulphate and ammonium phosphate.

U.S. limestone output last year amounted to over 13,000,000 tons and was worth nearly \$15,000,000. Most important uses were in alkali works and in refractories, next in order of importance being calcium carbide works, glass factories and sugar refineries.

Another ersatz story from Germany, reported in the Swedish press, says that Nazi scientists have found a new source of fat. Certain species of fungi, grown on whey or a mixture of whey and fruit waste, are said to yield a very high percentage of fat.

Production of magnesium castings in the U.S.A. has reached a rate three times as great as in December, 1941, when the U.S. entered the war. Much of the expansion is due to companies new in the field, whose previous experience has been in other metals, notably grey iron and aluminium.

Germany's synthetic rubber output is insufficient to meet her export commitments to Sweden. The Swedes, who are now having to withdraw 7000 lorries from road service owing to tyre shortage, say this is due to the damage done by the R.A.F. to the Buna-rubber plant at Hanover.

The Dairy Research Institute of New Zealand has perfected a butter-substitute which retains its body at temperatures up to 105° F. and can be used by the armed forces in the tropics. Percentage composition is: butterfat, 60; stearine, 20; dried milk, 20.

All the rubber Canada needs for war and all that is likely to be needed after the war will be made at Sarnia, in a Government-owned plant, according to the Dominion Minister of Munitions and Supply. The artificial rubber plant at Sarnia, using petroleum as a base, will probably be in full operation by November on its programme of an annual production of 34,000 tons of Buna-S rubber and 8000 tons of butyl rubber.

The new cement plant at Northampton, Pasadena, is described as being the finest and most modern in the world. Its rotary kilns are fired with powdered coal, and waste heat from them is conserved as electric power by means of steam turbines. The plant will make the first American white and calcium-aluminate cements.

A new Brazilian company, Industria Química Iguassu, is processing dolomite in a plant near Curityba. The factory has complete equipment for separating magnesium from calcium by sulphuric acid treatment. Every month 30,000 kg. of Epsom salts are made, and the calcium sulphate that remains is converted into plaster-of-Paris.

Production of wattle-bark, a substitute for sumach in tanning, has reached such importance that the Tanbark Development Syndicate of Australia has over 1500 acres in Victoria planted with wattle trees. South Africa's 50-year-old industry derives from Australian seed, the wattle being a native of the Antipodes.

In the campaign against the locust in East Africa, which Dr. Uvarov recently described at Nairobi, 40,000 bags of poison bait were carried for an average of 200 miles before use, 300,000 gallons of water had also to be transported for preparing the insecticide, and 10,000 gallons of drinking water per diem had to be boiled or chlorinated. In spite of the extreme danger to the troops and labourers employed, by poisoning from the soluble arsenic salts, only one case occurred and the patient recovered. The campaign was a complete success.

An explosion last week demolished a five-storey plant at Kearney, N.J., U.S.A., where camouflage materials were manufactured, and in which, it is stated, "volatile chemicals" were used. Seven persons are known to have been killed. Interesting features of the accident were that it took place during the change-over from the day to the night shift (always a risky time) when only 30 workers were on the plant, and that, while the building in which the explosion occurred did not take fire, adjacent buildings were set alight by the flying debris.

Company News

Reckitt & Sons, Ltd., have declared an interim dividend of 5 per cent. (same).

Boots Pure Drug Co., Ltd., announce an interim dividend of 10 per cent. on the ordinary shares (same).

W. J. Bush & Co., Ltd., report a net profit for 1942 of £153,304 (£160,818) and are paying a final dividend of 6 per cent., making 10 per cent. for the year (same). Forward, £190,767 (£178,341).

The United Glass Bottle Co., Ltd., announce an interim dividend of 3½ per cent. (same).

Anglo-Greek Magnesite, Ltd., reports that income on investments (valued at £99,620) amounted to £3575 for the 15 months to March 31. Liquid assets in England total £101,622.

Commercial Alcohols, Ltd., of Canada, for the year ended March 31, 1943, announce a net profit of \$63,700 (\$90,111) and have declared a dividend of 20 cents a share on ordinary shares.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

MAJOR & CO., LTD., London, W.C., coal tar and petroleum distillers. (M., 28/8/43.) August 3, mortgage to Barclays Bank, Ltd., securing all moneys due or to become due to the bank, charged on certain moneys.

Receivership

CHARLES DAY & CO., Ltd. (B., 28/8/43), purifiers of gums for making varnish, etc., 40 George Street, Richmond, Surrey. Helen Day, 149 Northumberland Park, Tottenham, appointed receiver on July 31, under powers contained in debentures dated August 9, 1907.

Winding-Up Petition

CHARCOAL INDUSTRIES, LTD. (W.U.P., 28/8/43.) A petition for the winding-up of the above company by the High Court of Justice was, on August 4, presented by The Empire Charcoal Company, creditors of the said company, and is to be heard at the Royal Courts of Justice, Strand, London, on October 18.

New Companies Registered

Plant Hormones, Ltd. (382,142).—Private company. Capital: £1000 in 1000 shares of £1 each. Manufacturers of and dealers in organic and inorganic chemical products for use in agriculture, etc. Directors: A. J. Wuertz-Field; C. H. Temple. Registered office: Mount Pleasant, Alperton, Wembley, Middlesex.

Rogo Chemical Industries, Ltd. (382,287). Private company. Registered August 19. Capital: £1000 in 1000 shares of £1 each. Manufacturers of and dealers in chemicals, dyestuffs, disinfectants, insecticides, fertilisers, etc. Directors: G. Rogers; J. M. B. Gorden. Registered office: 62 Cranbourne Gardens, N.W.11.

Chemical and Allied Stocks and Shares

SENTIMENT in Stock Exchange markets was dominated by the general tendency to await the next important war development. In the absence of improvement in the volume of business, industrial shares were slightly reactionary, though only a moderate amount of selling was again in evidence. In fact, the general undertone was fairly steady, and British Funds were firmer. British Celanese, and various other shares in which a substantial rise has been recorded in recent weeks, were inclined to fluctuate, but in many cases movements in securities of chemical and kindred companies did not exceed more than a few pence.

Imperial Chemical were 38s. 10½d. compared with 39s. 3d. a week ago; the interim dividend is due to be announced in September and it is generally expected it will again be 3 per cent. In fact, the market remains confident that the I.C.I. total distribution will be kept at 8 per cent. Lever & Unilever at 37s. 6d. were unchanged on balance. In this case the financial results fall to be issued towards the end of next month or early in October. Borax Consolidated at 37s. were 3d. better than a week ago, and British Aluminium at 49s. 6d. were unchanged on balance. W. J. Bush ordinary were again quoted at 53s. 9d. and remained firmly held on the financial results, it being realised that profits are again being dealt with conservatively and that earnings on the shares are well in excess of the dividend, which is again limited to 10 per cent. At 64s. Associated Cement were within 6d. of the level ruling a week ago, but at the time of writing, British Plaster Board have eased a few pence to 28s. 6d.

British Drug Houses were again 23s., and Monsanto "Chemicals 5½ per cent. preference 23s. 6d., while dealings up to 7s. 9d. have been shown in Greiff-Chemicals 5s. ordinary. Burt Boulton were again 19s. Leeds Fireclay ordinary and preference have held recent gains, the assumption being that the results, due next month, are likely to show better earnings and a further payment on the preference shares. British Oxygen were higher at 77s. compared with 76s. 6d. a week ago. Elsewhere, United Molasses, which remained under the influence of the financial results and annual statement, were

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little changed on balance at 31s. 6d. The units of the Distillers Co. improved from 86s. 9d. to 87s. 3d. Moreover, at the time of writing, Triplex Glass 10s. ordinary have held their recent rise to 37s. 1½d. Wall Paper Manufacturers deferred units regained most of an earlier decline and at 41s. 9d. were little changed on balance. At 80s. 3d. Turner & Newall were virtually the same as a week ago.

British Celanese fluctuated, and were 33s. 4½d. compared with 34s. a week ago. Courtaulds showed improvement on balance from 55s. 3d. to 56s. Elsewhere, Calico Printers ordinary and preference were inclined to improve, awaiting the financial results. Bradford Dyers further improved from 21s. to 22s. 6d. At 156s. 3d. Thomas De La Rue were unchanged on balance, British Industrial Plastics 2s. shares were 6s. 4½d., and Erinoid 5s. ordinary 12s. 6d. Financial results of the last-named company are due in October. In other directions, Murex rallied to 102s. 6d., while General Refractories 10s. ordinary continued in better demand and showed further improvement from 17s. 4½d. to 17s. 7½d. Imperial Smelting were again 15s. 6d., but elsewhere, Amalgamated Metal moved back from 19s. 9d. to 19s. 3d. At 19s. 6d. Gas Light & Coke ordinary remained the same as a week ago. Among other securities, however, Babcock & Wilcox have reacted from 48s. to 47s. at the time of writing, but Dorman Long held their recent improvement to 26s. 9d., Guest Keen moved up from 33s. to 33s. 6d., and United Steel were little changed at 24s. 10½d. Among other shares, Boots Drug ordinary were maintained at 43s. 9d., Sangers were 22s. 10½d., and Timothy Whites 31s. 1½d. Oil shares lost part of the gains recorded a week ago.

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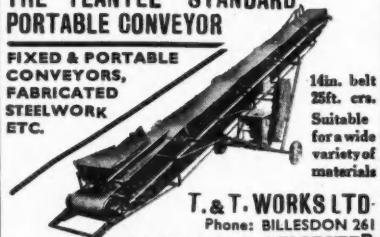
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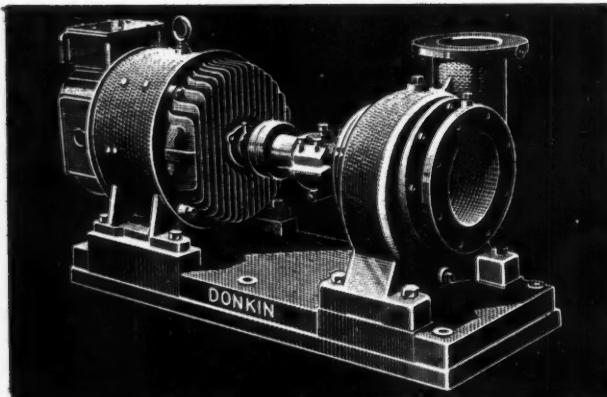
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